exposes the metal layer **120**, and the hole bottom **133** of the contact hole **131** has a second width L2 along the first direction X.

The applicant has discovered that the liquid-crystal molecules are arranged along the contiguous wall **132**, and the light transmittance is changed with the slope of the contiguous wall **132**. At the location where the tangent slope of the contiguous wall **132** is about tan 10°, light leakage in dark state is acceptable, and the contrast ratio of the liquid-crystal display is qualified. When the edge of the metal layer **120** extends to the critical point **136** (where the tangent slope of the contiguous wall **132** is about tan 10°, the aperture ratio (transmittance) and the contrast ratio are optimized.

With reference to FIG. **2**A, the applicant has discovered from deriving curve equations that when the first width and the second width satisfy the following equation, the aperture ratio and the contrast ratio are optimized:

$$2*\left\{\frac{L_2}{2}+\frac{0.95h}{\ln(0.5)\cdot\tan(1.5\theta)}\cdot\ln\left[\frac{-\tan\delta\cdot 0.95}{\ln(0.05)\cdot\tan(1.5\theta)}\right]\right\}-3.8\leq$$
$$L_1\leq 2*\left\{\frac{L_2}{2}+\frac{0.95h}{\ln(0.05)\cdot\tan(1.5\theta)}\cdot\ln\left[\frac{-\tan\delta\cdot 0.95}{\ln(0.05)\cdot\tan(1.5\theta)}\right]\right\}+3.8$$

wherein L_1 is the first width of the metal layer **120** along the first direction X, and L_2 is the second width of the hole bottom **133** of the contact hole **131** along the first direction X, h is a first thickness (the first thickness is a distance between the top of the planarization layer **130** and the bottom of the planarization layer **130** along the second direction Z in a pixel region), δ is an angle between 5 degrees to 20 degrees, θ is an included angle between a straight line L and an extension surface of the hole bottom **133**. The straight line L connects a reference point **134** and a base point **135**, the reference point **134** and the base point **135** are located on the contiguous wall **132**, wherein a distance from the reference point **134** to bottom of the planarization layer along the second direction is 0.95h. The base point **135** is located at the point where the contiguous wall **132** is connected to the hole bottom **133**, and ±3.8 is the tolerance. By modifying the parameters above, the curvature and the shape of the contiguous wall **132** can be modified.

The tangent slope of a particular point on a top curvature of the polarization layer **130** is tans, and the angle δ is an included angle (acute angle) between a tangent line of the particular point and a horizontal line passes through the particular point (the horizontal line is perpendicular to the second direction Z). The angle δ of particular point corresponding to the pixel region (PXR) is between 0 to 2 degrees. The angle δ of particular point corresponding to the contact region (CTR) is between 2 degrees to 90 degrees. The critical point **136** is one of a set formed by a plurality of particular points of the contact region. In the embodiment above, in the contact region, the angle δ is an angle between 5 degrees to 20 degrees to make optimization between the aperture ratio (transmittance) and contrast ratio of the liquid crystal display. In one embodiment, to achieve an improved aperture ratio (transmittance), the angle δ is smaller than 10 degrees, and the angle δ is greater than or equal to 5 degrees (5 degrees≤δ<10 degrees). In another one embodiment, to achieve an improved contrast ratio (low light leakage in dark state), the angle δ is greater than 10 degrees, and the angle δ is smaller than or equal to 20 degrees (10 degrees<δ≤20 degrees).

With reference to FIG. **2**A, the derivative of the curve equation is presented in the following description.

First, curve fitting (assuming), assuming a curve equation of the contiguous wall of the contact hole is:

$$y=f(x)=-A'\exp(-x) \tag{1}$$

In equation (1), only asymptotes of the contiguous wall are defined, and the equation (1) must be regulated relative to the first direction X (X axis) and a third direction Y (Y axis), wherein the first direction X, the second direction Z, and the third direction Y are perpendicular to each other.

Next, the curve fitting (relative to reference point **134**, base point **135** and included angle θ), assuming that a distance between the reference point **134** and the top of the planarization layer **130** is p times of the thickness h of the planarization layer **130**, and satisfies equation f(R'), and the horizontal distance between the reference point **134** and the base point **135** is R', then:

$$f(R')=-\mathrm{ph}=-h\exp\left(\frac{-R'}{\alpha}\right) \tag{1}$$
$$\Rightarrow\alpha=\frac{-R'}{\ln(p)};$$
$$p>0,\ h>0,\ R'>0 \tag{2}$$

Correction parameter α is achieved.

Next, a straight line L connects the reference point **134** and the base point **135**, and an included angle between a straight line and the horizontal line is θ, then:

$$\tan\theta=\frac{(1-p)h}{R'} \tag{3}$$
$$\Rightarrow R'=\frac{(1-p)h}{\tan\theta}$$

Material property θ is brought in.

Next, a distance between the reference point and the bottom of the planarization layer along the second direction Z is 0.95h. By combining equations of equation (2) and equation (3), we get:

$$\alpha=\frac{-R'}{\ln(0.05)}=\frac{-0.95h}{\ln(0.05)\cdot\tan\theta} \tag{4}$$

Correction parameter α is achieved.

Next, the included angle β between a cut line L' at base point **135** and the horizontal line defines the angle of the curve of the planarization layer **130**, and included angle β is about 1.5θ. Therefore, by revising the curve equation (angle revising) further, we get:

$$f(R')=-h\cdot\exp\{-R'/\alpha\}=-h\cdot\exp\left\{R'\cdot\frac{\ln(0.05)\cdot\tan\beta}{0.95h}\right\} \tag{5}$$
$$=-h\cdot\exp\left\{R'\cdot\frac{\ln(0.05)\cdot\tan(1.5\theta)}{0.95h}\right\}$$

Curve equation of the contact hole is achieved.

Next, $R=R_0+R'$, by bringing this equation into the above equation, we get:

$$\because R'=R-R_0\ \ldots\ (shiftting) \tag{6}$$